

GULYAYEV, Aleksandr Pavlovich, prof., doktor tekhn.nauk; RAKHSHTADT,
A.G., kand.tekhn.nauk, retsenzent: RZHAVINSKIY, V.V., inzh.,
red.izd-va; CHERNOVA, Z.I., tekhn.red.

[Heat treatment of steel] Termicheskaya obrabotka stali.
Izd.2., perer. i dop. Moskva, Gos.nauchno-tekhn.izd-vo mashino-
stroit.lit-ry, 1960. 495 p. (MIRA 13:7)
(Steel--Heat treatment)

18.1215, 18.7100

7752
307/129-00-2-5/13

AUTHORS: Rakhshtadt, A. G., Rogel'berg, I. L. (Candidates
of Technical Sciences), Vorob'yeva, L. P., Puchkov,
B. I. (Engineers)

TITLE: Effect of Heat Treatment on Properties and Structure
of Beryllium Bronze

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov,
1960, Nr 2, pp 20-31 (USSR)

ABSTRACT: Beryllium bronze possesses elastic properties,
high corrosion resistance, and adequate electric
conductivity. It is used for the elastic elements
of instruments and devices. Inasmuch as previous
works failed to study the elastic properties of this
bronze, the authors investigated elastic and re-
laxation properties of the bronze prepared in the form
of thin strip. The modulus of elasticity was de-
termined by the dynamic method according to the
frequency of resonant-type vibration of a cantilever.

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specimen. Elastic limit was determined by means of longitudinal bending of the specimen according to the method described in Rakhantadt, A. G., and Shtremel', M. A., Collection MVTU imeni Bauman, Physical Metallurgy and Heat Treatment, Masngiz, 1955. Residual elongation of the external fiber was calculated by formulas of Ye. P. Popov (Popov, Ye. P., Theory and Calculation of Flexible Elastic Parts, Publishing House LKVVIA, 1947). Permissible residual deformation in determining elastic limit amounted to 0.001 to 0.01%. Relaxation characteristic was determined on the strip bend around mandrels of various diameters. The following types of bronze were investigated: (1) Br B2 (Be, 2.07; Ni, 0.2%); (2) Br B2.5 (Be, 2.56; Ni, 0.31%); (3) Br BNT (Be, 1.9 to 2.02; Ni, 0.32; T, 0.19%). For this purpose, 10-kg ingots 40 mm thick were hot-rolled at 600-800° C into 4.5 mm thick strip with maximal reduction of 20-30%

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and Structure of Beryllium Bronze

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SOV/129-66-A-5/13

per pass. Rolled strip was hardened from 300° C (holding time 1 hr and water quenching). After pickling, specimens were cold-rolled and hardened according to the above rates at strip thicknesses of 3, 1.5, and 0.7 mm. Then, the strip was rolled to 0.6, 0.43, 0.33, and 0.30 mm thickness. Subsequently, the specimens were hardened in water from 780 to 790° C and rolled to an identical thickness of 0.3 mm; i.e., with reductions of 50, 30, and 10% and without deformation. Hardening from 780 to 790° C (holding for 10 min and water-cooling at 20° C) was done, since such heating brings about a sufficient concentration of beryllium in alpha-solution and fine grain structure (10-15 μ grains). Mechanical and physical properties of the above bronze specimens corresponded to those given in literature for bronzes containing 2 and 2.5% Be. Figure 2 shows changes of elastic properties, hardness, and electrical resistance of bronze Br B2.5 under the effect of tempering. Similar figures are given in the paper for the other two types of bronze.

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and Structure of Beryllium Bronze

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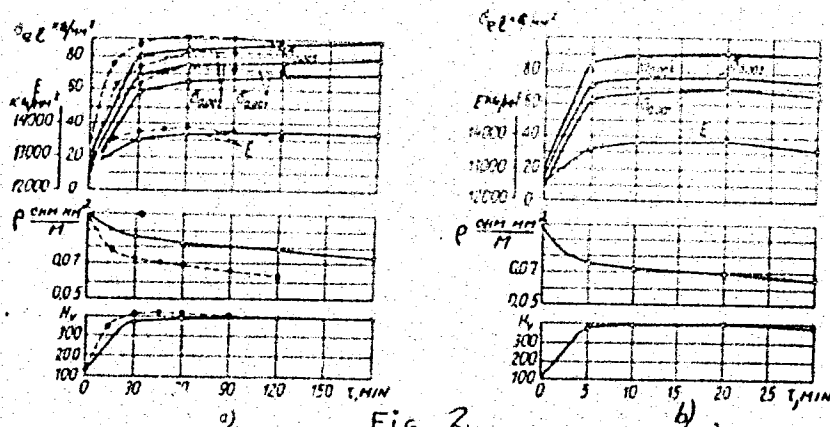


Fig. 2.

See Card 5/10 for caption.

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Caption to Fig. 2 on Card 4/10

Fig. 2. Change of elastic properties, hardness, and electrical resistance of beryllium bronze Br B2.1 after tempering. (a) — at 320° C; ---- at 350° C; (b) at 370° C. $\sigma_{0.1}$, elastic limit; E, modulus of elasticity; ρ , electrical resistance, $\text{ohm} \cdot \text{mm}^2$; H_V , Vickers hardness; subscripts at

$\sigma_{0.005}$, $\sigma_{0.002}$, $\sigma_{0.01}$, residual deformation.

Bronze Br BNT 1.9 has a higher elastic limit than the other two types of bronze. It also exceeds that indicated in Richards, J., Materials and Methods, Vol 31, No 3, 1950, and in some Soviet references. This may be ascribed not only to a different method of investiga-

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Effect of Grain Orientation on Relaxation
and Structure of Polycrystalline Bronze

1974-01-2-13

tion but also to the use of thin strip with a highly homogeneous structure. The rate of relaxation at the initial stress equal to elastic limit (at $\sigma_{0.005}$) is higher after tempering at 320°C for 3 hours than that after tempering at 350°C for 1 hour or at 370°C for 20 minutes (see Fig. 7).

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and Structure of Beryllium Bronze

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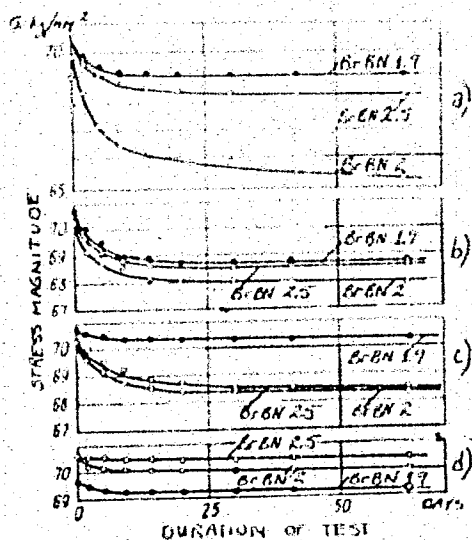


Fig. 7. Change of stresses as the result of relaxation of beryllium bronze at 20° C after hardening and tempering. (a) 320° C, 3 hr; (b) 350° C, 1 hr; (c) 370° C, 20 min; (d) 350° C after reduction of 30%.

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and Structure of Beryllium Bronze

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Plastic deformation following hardening strengthens the bronze and increases its elastic limit and hardness, but affects the modulus of elasticity only slightly (see Fig. 9).

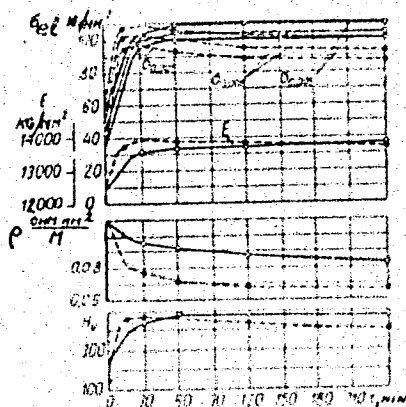


Fig. 9. Change of elastic properties, hardness, and electrical resistance of beryllium bronze Br 2.5 after hardening, cold plastic deformation (reduction 30%), and tempering: — at 300° C; ---- at 350° C.

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and Structure of Beryllium Bronze

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609.137-40-44/13

As a result of this study the following conclusions have been made: (1) heat treatment and plastic deformation drastically affect elastic properties and structure of beryllium bronze; (2) tempering at 350-370° C increases elastic limit and modulus of elasticity of hardened bronze which reaches its maximum with a holding time of 1 hour at 350° C and 20 minutes at 370° C; (3) bronzes containing 2 or 2.5% Be behave identically in regard to strengthening. Additions of Ti bring about a further increase of the elastic limit; (4) bronzes with 2.5 and, particularly, with 2% Be are characterized by nonuniform microscopic decomposition in tempering with higher rates of decomposition along grain boundaries; (5) deformation of hardened bronze changes the state of initially hardened solid solution only with high reduction (30 and 50%); (6) tempering of hardened beryllium bronze subjected to plastic deformation promotes the value of elastic limit ($\sigma_{0.001}$ =

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and Structure of Beryllium Bronze

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100 kg/mm²). There are 10 figures; 4 tables; and 38 references, 22 Soviet, 12 U.S., 2 German, 1 U.K., 1 French. The 5 most recent U.S. and U.K. references are: Kelly, A., Acta Metallurgica, Nr 8, 1958; Richards, J., ASTM, Spec. Tech. Publication, Nr 129, 1952; Richards, J., Materials and Methods, Vol 31, Nr 4, 1950; Beck, P., Journ. Appl. Physics, Vol 20, Nr 7, 1949; Friedel, J., Phil. Magazine, Vol 44, Nr 351, 1953.

ASSOCIATION: Moscow Higher Technical School imeni Bauman (MVTU imeni Baumana), State Design and Planning Scientific Research Institute for Working of Nonferrous Metals (Giprosvetmetobrabotka)

Card 10/10

18 1220

24596

S/137/61/000/005/052/060
A006/A106

AUTHORS: Rakhshadt, A. G., and Zakharov, Yu. V.

TITLE: Transformations, properties and treatment of Cu-Ni-Mn system spring alloys

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 5, 1961, 28, abstract 5I213 (V sb. "Metallovedeniye i term obrabotka metallov" [Tr. Sektsii metalloved. i term. obrabotki metallov. Tsentr. pravl. Nauchno-tekhn. o-va mashinostroit. prom-sti, no. 2] Moscow, 1960, 135-159)

TEXT: The effect of heat treatment on the properties of 60-20-20 type alloys (60% Cu, 20% Ni, 20% Mn) was determined by measuring the hardness, internal friction E, electric resistivity and by microstructural and roentgenostructural analyses. It was found that strengthening depended on ordering (formation of θ' -phase, consisting of antiphase domains, separated by deficient layers) which begins and proceeds near the grain boundaries. The strong effect of quenching temperature on strengthening after tempering is caused by a fine-grained structure with crushed domains after low-temperature quenching. Plastic deformation of the alloy after quenching produces fine structure and eliminates the

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Transformations, properties and treatment ... 24596

S/137/61/000/005/052/060
ACG6/A106

effect of quenching temperature on strengthening during tempering. The addition of small B admixtures distributed along the boundaries of grains and domains retards considerably structural processes entailing strengthening but somewhat raises σ_e of the alloy and its relaxation stability during heating. Best properties are obtained after low-temperature quenching from 550°C and tempering at 400°C (10 hours). As a result of quenching at a heterogeneous fine-grained structure (solid solution on Cu and θ' phase base) satisfactory ductility is preserved. Tempering assures high strengthening. The relaxation stability during heating and resistance to weak deformation of a 60-20-20 alloy exceed those of expensive Be-bronze. σ_e of the 60-20-20 alloy without B is 78 kg/mm^2 ; with B it is 86 kg/mm^2 , σ_e of 6p.52 (BrB2) is $80 - 85 \text{ kg/mm}^2$; and of 6p.52.5 (BrB2.5) it is $80 - 90 \text{ kg/mm}^2$. The 60-20-20 alloy can be employed for the manufacture of various types of spring. There are 26 references.

V. K.

[Abstractor's note: Complete translation]

Card 2/2

PUCHKOV, B.I.; RAKHSHTADT, A.G.; ROGEL'BERG, I.L.

Studying stress relaxation in copper alloy springs. Izv. vys.
ucheb. zav.; tsvet. met. 3 no.4:145-152 '60. (MIRA 13:9)

1. Vsesoyuznyy zaochnyy politekhnicheskii institut. Kafedra metal-
lovedeniya i termicheskoy obrabotki metallov.
(Springs (Mechanism)--Testing)
(Copper alloys--Testing)

RAKHSHTADT, A.G.

82LHh

S/149/60/000/004/008/009

18 1220

AUTHORS: Puchkov, B.I., Rakhshtadt, A.G., Rogel'berg, I.L.

TITLE: Investigation Into Relaxation of Copper Alloys for Springs

PERIODICAL: Izvestiya vysshikh uchastnykh zavedeniy, Tsvetnaya metallurgiya, 1960, No. 4, pp. 145-152

TEXT: Information is given on results of investigations into the relaxation of stress of basic copper alloy grades, used for the manufacture of springs. The authors tested 0.3-mm thick strips of the following materials: aluminum bronze $\text{CuAl} 7$ and $\text{CuAl} 9-2$ (BrA7 and BrAMts 9-2); tin bronze $\text{CuSn} 6.5-0.15$ (BrOF 6.5-0.15), $\text{CuSn} 4-0.25$ (BrOF 4-0.25), $\text{CuSn} 4-3$ (BrOFs 4-3); brass $\text{CuZn} 85$, $\text{CuZn} 68$, $\text{CuZn} 62$ (L85, L68, L62); German silver $\text{CuNi} 15-20$ (MNTs 15-20); manganese silicide bronze $\text{CuMnSi} 3-1$ (BrKMts 3-1); beryllium bronze $\text{CuBe} 2$ (BrB2) and copper-nickel-manganese alloy $\text{CuNiMn} 20-20$ (MNMts 20-20). The method of bending thin flat specimens was used for the relaxation tests. The method of mechanical tensometry was employed to determine the decrease in stress, caused by relaxation, from changes in the radius of curvature of the specimens after holding them at a given temperature for a given time. The relaxable stress was calculated by the following formula:

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Investigation Into Relaxation of Copper Alloys for Springs

$$\tau_r = \frac{Eh}{2} \left(\frac{1}{R} - \frac{1}{r} \right)$$

where E is the modulus of normal elasticity, kg/mm²; h is the thickness of the strip, mm; R is the initial radius of curvature, mm; r is the radius of curvature of the strip after relaxation. The relaxation of stress was studied depending on the temperature (200-350°C); the degree of preliminary cold deformation; the magnitude of initial stress and the sense of the specimen cut-out in respect to the sense of rolling. The magnitude of initial stress, approaching the elastic limit, was calculated by the extrapolation method. The following results were obtained: In alloys strengthened by deformation the highest relaxation stability was observed at 200-350°C in MnTs 15-20, BrAMts 9-2, BrKMts 3-1 and BrOTs 4-3; in the group of alloys strengthened by heat treatment highest relaxation stability at 250°C was revealed in the MnMts 20-20 alloy, exceeding that of beryllium bronze, which showed high relaxation stability up to 200°C. For alloys strengthened by hard facing, the relaxation process, occurring at temperatures below the beginning of recrystallization, may be described by the relation $\sigma_r = \sigma_0 - K \lg \tau$. The relaxation rate increases noticeably after the temperature of recrystallization has been attained. The magnitude of the relaxation stress decreases and the relaxation rate increases with a higher degree of preliminary cold deformation. For alloys

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Investigation Into Relaxation of Copper Alloys for Springs

strengthened by heat treatment, the dependence of the $\sigma_T = G_T \cdot \lg T$ type is applicable up to temperatures corresponding to the preservation of the initial structural state. Slight hot hard facing increases the relaxation stability. This is of considerable practical interest. There are 7 sets of graphs, 2 tables and 13 Soviet references.

ASSOCIATION: Vsesoyuznyy zaachnyy politekhnicheskii institut (All Union Polytechnic Institute of Correspondence Courses) Kafedra metallovedeniya i termicheskoy obrabotki metallov (Department of Metal Science and Thermal Treatment of Metals)

SUBMITTED: September 15, 1959

Card 3/3

S/133/60/000/005/003/003

AUTHORS: Rakhshtadt, A. G., Candidate of Technical Sciences, Docent,
 Sol'ts, V. A., Candidate of Technical Sciences,
 Moiseyev, V. F., Engineer

TITLE: Heat Treatment¹⁸ of Spring Alloys¹⁹ Used at High Temperatures

PERIODICAL: Stal', 1960, No. 5, pp. 468-472

TEXT: Tests were carried out on the elastic properties of three types of spring steels during heating under various conditions. First two austenitic spring steels were tested with the following composition: an M 702 (EI702) type alloy: H36XT10 (N36KhTYu) Cr 12.0%; Ni 35.1%; Ti 2.98%; Al 0.68%, marked ПА (PA), and an M 702 (EI702) type alloy: H36XT10M (N36KhTYuM5) Cr 0.035%; Si 0.39%; Mn 1.15%; Ni 35.9%; Cr 13.08%; Ti 2.79%; Al 1.23% and Mo 4.70%, marked ПБ (PB). The ingots tested were forged, cold- and hot-rolled, with intermediate hardening at 1,000-1,100°C. The samples were pressed from cold-rolled strips 0.3 mm thick. The heat treatment for the PA alloy differed from the conventional inasmuch as after hardening (started at 950°C) in water tempering took place during 8 hours instead of 2-3 hours at 750°C, in order to stabilize the structure more effectively

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S/133/60/000/005/003/003

Heat Treatment of Spring Alloys Used at High Temperatures

and to obtain a higher heat-resistance, although this could only be done at the expense of the elasticity limit at normal temperature. After establishing and comparing the limits and the moduli of elasticity, as well as the electrical resistance of both Alloys subjected to the same condition of heat treatment, it was found that by adding molybdenum to the EI702 N36KhTYu alloy the bond strength in the lattice of the solid solution was increased resulting in a higher strength and hardness of the alloy both after hardening and tempering, while the kinetics of hardening were not changed essentially. The moduli of elasticity for both types (PA and PB) changed in linear relation with the test temperature and this conformity promoted the thermal compensation of the changes in the elasticity modulus and is a valuable property of spring steels used in instruments. Tests at various holding times (25 sec and 1 hour) and different temperatures established that the PA steel was not sufficiently heat-resistant and when improving its heat-resistance by hardening at 1,100-1,150°C its elastic properties were lowered. On the other hand, the PB steel kept its high elastic properties even at 300°C on account of the strengthening of the boundary zones of the crystal grains in connection with the reduced extent of the decomposition of the solid solution and the general increase in the

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S/032/60/026/06/26/044
B010/B016

AUTHORS: Rakhshtadt. A. G., Shtremel', M. A.

TITLE: New Method of Determining the Elastic Limit on Thin Flat Samples

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 6, pp. 744-749

TEXT: A method of determining the elastic limit is described, as well as a device developed and used by the authors since 1953. This device is applied along with the apparatus for the determination of the micro-hardness of the ПМТ(PMT)-2, or ПМТ(PMT)-3 type. The mode of action of this device consists in that the flat parts are subjected to a longitudinal bending up to a definite deformation and the deflection which remains after unloading is measured by a microscope by the method of focusing. The device used to bend the specimen is described briefly by the aid of a graph (Fig. 1). The maximum relative increase in length on longitudinal bending is calculated by the method of Ye. P. Popov. The equations as well as a nomograph (Fig. 4) which are applied to determine

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New Method of Determining the Elastic
Limit on Thin Flat Samples

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B010/B016

the elastic limit by means of the apparatus described, are given. The total error of the determination is ca 2 per cent. As example, diagrams (Fig. 5) are given concerning the change of the properties of a σ_p BHT (Br BHT) 1.9 beryllium bronze after ageing at 370°C . When determining the elastic limit by tension or deflection, different results are obtained owing to residual stress. Equations are derived which permit the mutual conversion of the diagrams of both tests. There are 5 figures and 10 references: 8 Soviet and 2 American. ✓

ASSOCIATION: Vysshaye tekhnicheskoye uchilishche im. Baumana (Technical
Institution of Higher Learning imeni Bauman). Moskovskiy
institut stali im. I. V. Stalina (Moscow Institute of Steel
imeni I. V. Stalin)

Card 2/2

VOROB'YEV, Vladimir Grigor'yevich; RAKHSHTADT, A.G., otv. red.;
NIKOLAYEVA, T.D., red.; PAVLOVA, V.A., tekhn. red.

[Theory of heat resistance. Heat resistant steels and alloys] Teoriia zharoprochnosti. Zharoproschnye stali i splavy; lektsiia dlia studentov mashinostroitel'skikh spetsial'nostei, izuchaiushchikh kurs "Metallovedenie i termicheskaiia obrabotka," i studentov metallurgicheskogo fakul'teta, izuchaiushchikh kurs "Termicheskaiia obrabotka." Moskva, Gos.izd-vo "Vysshiaia shkola," 1961. 74 p. (MIRA 16:4)
(Steel, Heat-resistant) (Heat-resistant alloys)

88267

S/032/61/027/001/025/037
B017/B054

1.9600
AUTHORS:

Geveling, N. N., Puchkov, B. I., Rakhmatdt, A. G., and
Rogel'berg, I. L.

TITLE:

Device for Measuring the Relaxation of Stress in Thin Metal
Tapes on Bending

PERIODICAL: Zavodskaya laboratoriya, 1961, Vol. 27, No. 1, pp. 89-91

TEXT: To study the relaxation of stress in thin metal tapes made of
spring alloys, the tapes were attached to cylindrical frame by means of
two ledges. The magnitude of initial stress depends on the frame diameter
and thickness of the metal tape. The relaxation stress is calculated from
the equation $\sigma_r = 0.5 E h \left(\frac{1}{R} - \frac{1}{r} \right)$, where E = modulus of elasticity,
 h = thickness of the metal tape, R = initial radius of the arc, and
 r = arc radius after relaxation. The kinetics of the relaxation stress
was studied with beryllium bronze. There are 3 figures and 5 Soviet
references.

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Devices for Measuring the Relaxation of Stress
in Thin Metal Tapes on Bending

S/032/61/027/001/025/037
B017/B054

ASSOCIATION: Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana
(Moscow Higher Technical School imeni Bauman),
Giprotsvetmetobrabotka (State Design and Planning Scientific
Research Institute for the Processing of Nonferrous Metals)

Card 2/2

ALFEROVA, N.S., doktor tekhn. nauk; BERNISHTEYN, M.L., kand. tekhn. nauk; BLANIER, M.Ye., doktor tekhn. nauk; BOKSHEYN, S.Z., doktor tekhn. nauk; VINOGRAD, M.I., kand. tekhn. nauk; GAMOV, M.I., inzh.; GELLER, Yu.A., doktor tekhn. nauk; GOTLIB, L.I., kand. tekhn. nauk; GRDINA, Yu.V., doktor tekhn. nauk; GRIGOROVICH, V.K., kand. tekhn. nauk; GULYAYEV, B.B., doktor tekhn. nauk; DOVGAEVSKIY, Ya.M., kand. tekhn. nauk; DUDOVTSSEV, P.A., kand. tekhn. nauk [deceased]; KIDIN, I.N., doktor tekhn. nauk; LEYKIN, I.M., kand. tekhn. nauk; LIVSHITS, B.G., doktor tekhn. nauk; LIVSHITS, L.S., kand. tekhn. nauk; L'VOV, M.A., kand. tekhn. nauk; MEYERSON, G.A., doktor tekhn. nauk; MINKEVICH, A.N., kand. tekhn. nauk; NATANSON, A.K., kand. tekhn. nauk; NAKHIMOV, A.M., inzh.; NAKHIMOV, D.M., kand. tekhn. nauk; OSTRIN, G.Ya., inzh.; PANASENKO, F.L., inzh.; SOLODIKHIN, A.G., kand. tekhn. nauk; KHMUSHIN, F.F., kand. tekhn. nauk; CHERNASHKIN, V.G., kand. tekhn. nauk; YUDIN, A.A., kand. fiz.-mat. nauk; YANKOVSKIY, V.M., kand. tekhn. nauk; RAKHSHTADT, A.G., red.; GORDON, L.M., red. izd-va; VAYNSHEYN, Ye.B., tekhn. red.

(Continued on next card)

ALFEROVA, N.S.--- (continued) Card 2.

[Metallography and the heat treatment of steel]Metallo-
vedenie i termicheskaja obrabotka stali; spravochnik.
Izd.2., perer. i dop. Pod red. M.L.Bernshteina i A.G.
Rakhshtadta. Moskva, Metallurgizdat. Vol.2. 1962.
1656 p. (MIRA 15:10)

(Steel--Metallography)
(Steel--Heat treatment)

33467

S/129/62/000/001/010/011
E193/E383

18.1220

AUTHORS: Rakhshadt, A.G., Rogel'berg, I.L., Candidates of
Technical Sciences and Puchkov, B.I.,
Sveshnikova, G.A., Engineers

TITLE: A study of methods of increasing the strength of
copper-base spring alloys

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov,
no. 1, 1962, 45 - 56

TEXT: The object of the investigation described in the
present paper was to carry out a systematic study of the effect
of mechanical and thermal treatment on the mechanical properties
of several copper-base alloys. These included:
Л85 (L85) (84.67% Cu, remainder Zn); Л80 (L80) (79.18% Cu,
remainder Zn); Л68 (L68) (67.26% Cu, remainder Zn);
Бр.ОФ6.5-0.15 (Br. OF6.5-0.15) (6.4% Sn, 0.20% P); Бр.ОФ 4-0.25
(Br. OF4-0.25) (3.56% Sn, 0.28% P); Бр.ОЦ 4-3 (Br. OTs4-3)
(3.94% Sn, 3.1% Zn); Бр.А7 (Br. A7) (7.63% Al); Бр.КМЦ 3-1
(Br. KMts3-1) (2.82% Si, 1.15% Mn); МНЦ 15-20 (MNTs15-20)
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E193/E383

A study of methods of

(65.19% Cu, 14.75% Ni, remainder Zn). The alloys were melted in an induction furnace and the ingots, after two hot-rolling operations, were cold-rolled with intermediate anneals, the last anneal being carried out on sheet 1.5 mm thick. This was cold-rolled to the final thickness of 0.75, 0.5 or 0.375 mm. The mechanical properties were measured both on cold-rolled material and on specimens subsequently heat-treated. All the tests were carried out two months after the completion of thermal and mechanical treatment. The results can be summarized as follows. 1) Cold plastic deformation increases the hardness, elastic limit, elastic modulus and electrical resistance of all the alloys studied; this effect increases with increasing degree of cold-working and is associated with an increase in the dislocation density, formation of stacking faults and a change in the atomic structure of the alloys. Regarding the effect of alloying additions on the work-hardening characteristic of copper, tin has been found to be more effective than aluminium, silicon or zinc.

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A study of methods of

2) An additional increase in the mechanical properties, affected by cold plastic deformation, can be obtained by a low-temperature treatment carried out below the recrystallization temperature. The higher the degree of work-hardening, the more pronounced is the effect of this treatment. The changes brought about by cold-working alone or combined with low-temperature annealing are exemplified by the results obtained on aluminium bronze (alloy A7). These are reproduced in Fig. 15, where the increment of the elastic modulus (ΔE , kg/mm²), elastic limit (σ_{upr} , kg/mm²), Vickers hardness (HV) and electrical resistivity (ρ , Ω mm²/m) are plotted against the degree of cold deformation (%) without and with subsequent low-temperature annealing (continuous and broken curves, respectively); instead of the true elastic limit, the values of 0.002, 0.005 and 0.01% proof stress ($\sigma_{0.002}$, $\sigma_{0.005}$ and $\sigma_{0.1}$, respectively) are plotted. The increase in the elastic limit brought about by low-temperature annealing can be attributed to the resultant

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A study of methods of

relief of localized stresses, elimination of point defects, diffusion processes associated with atomic displacements, and redistribution of dislocations.

3) All the alloys studied in work-hardened condition are anisotropic in respect of their elastic properties. This effect is evidently associated with anisotropic distribution of dislocations on the active slip systems. Since the increase in the elastic limit brought about by low-temperature annealing is not the same in all directions, anisotropy of elastic properties in material subjected to this treatment is practically non-existent. This is demonstrated in Fig. 2, showing the magnitude of $\sigma_{0.005}$ (kg/mm²) in various directions, the vertical and horizontal directions corresponding to directions parallel and normal to the direction of rolling; graph 'a' relates to specimens cold-worked to 60% reduction, graph 'b' to specimens subsequently annealed under optimum conditions, as shown in Table 3; Curves 1 - 4 relate to 1 - L68, 2 - Br.OF6.5-0.15, 3 - Br.KMts3-1 and 4 - MNTs 15-20.

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A study of methods of

4) None of the alloys studied is in a stable condition after plastic deformation. Brasses, in particular, if loaded under conditions of stress different from those obtaining during the initial cold-working operation, suffer a decrease in strength. This effect is attributed to the destruction of atomic segregation brought about by the first plastic-deformation process.

5) The low-temperature treatment of work-hardened specimens of the alloys studied does not significantly increase their resistance to heavy plastic deformation, which indicates that the combined mechanical and thermal treatment does not bring about effective blocking of dislocations. It is for this reason that a sharp decrease in the elastic limit of brass and bronze A7 is produced when, after plastic deformation followed by low-temperature annealing, they are again plastically deformed even to a very small degree. Consequently, parts made of these alloys and treated in the manner described should not be stressed in service beyond the elastic limit.

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6) Low-temperature treatment of work-hardened alloys increases their relaxation stability. This is demonstrated by the relaxation (stress σ_r , kg/mm^2 versus time, hours) curves reproduced in Fig. 4 for a - L68, 6 - L80, 3 - L85, 2 - Br.OF4-0.25, 0 - Br.OF4-3, e - Br.OF6.5-0.15, * - Br.A7, 3 - Br.KMts 3-1, u - MNTs15-20, Curves 1 relating to specimens cold-rolled to 60% reduction and Curves 2 to specimens subsequently annealed according to the schedules shown in Table 3. In addition, low-temperature treatment increases the stability of elastic properties of the alloys under conditions of cyclic loading. For instance, in the case of a cold-rolled specimen of MNTs alloy, subjected to 10^5 cycles under a stress of 22.8 kg/mm^2 , the relaxation stress decreased after 360 hours from 57.5 to 26.2 kg/mm^2 ; in the case of specimens which after cold-working were annealed at

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300 °C for 3 hours, the relaxation stress decreased under the same conditions to 38.0 kg/mm² only; the elastic limit decreased by 5% in the former and remained constant in the latter case. There are 9 figures, 3 tables and 36 references: 30 Soviet-bloc and 6 non-Soviet-bloc. The four latest English-language references mentioned are: Ref. 14: O. Izumi - Journal of the Japan Institute of Metals, v.23, 1959; Ref. 34: R. Feder, A. Novick, D.B. Rosenblat - Journal Appl. Phys., v.29, 1958; Ref. 35: Le-Claire, D., Lomer, M.M., Acta metallurgica, v.2, no. 11, 1954; Ref. 36: A. Cottrell, R.G. Stoks - Proc. Royal Soc., v.A233, 1955.

ASSOCIATIONS: MVTU im. Bauman
Giprotsvetmetobrabotka

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S/129/62/000/004/004/010
E193/E383

AUTHORS: Rakhshtadt, A.G. and Shtremel', M.A.

TITLE: Resistance of metals and alloys to small plastic strains

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov,
no. 4, 1962, 22 - 27

TEXT: Based on both Soviet and foreign sources, the present paper is an exposition of modern views on the behaviour of metals under stresses near the elastic limit. A concept of elasticity threshold σ_0 is introduced. This is defined as the maximum stress which can be repeatedly applied to a material without producing residual stress measurable to a given degree of accuracy (e.g. 0.0002%); a stress larger than σ_0 will produce a residual strain which will increase on each loading. Determination of σ_0 during a tensile test can be rendered difficult by residual stresses of the first type which, under a stress lower than σ_0 can cause contraction of the test piece. It should

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Resistance of metals

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also be borne in mind that the onset of athermal plastic deformation cannot be detected at slow rates of strain since, once a certain duration of loading is exceeded, the results obtained can be obscured by an elastic after-effect, stress relaxation, etc. The role of dislocations in the initial stages of plastic deformation is discussed in the next paragraph, with particular reference to factors inhibiting the movement and formation of single dislocations. Finally, the part played by grain boundaries in the process studied is discussed in relation to fine slip, movement of dislocations and movement of grains one relative to the other. In conclusion, it is stated that in order to increase the elastic limit, endurance limit and relaxation stability of metals, it is necessary to increase their resistance to small plastic strains. This can be attained by work- or phase transformation-induced hardening and by dispersion hardening. The best results should be obtained by treatments which combine all these processes and which are exemplified by various types of thermomechanical treatment. There are 6 figures.

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S/133/62/000/004/008/008
A054/A127

AUTHORS: Bernshteyn, M.L.; Rakhstadt, A.G.; - Docents, Candidates of Technical Sciences

TITLE: Thermomechanical treatment of spring steel and its reversibility

PERIODICAL: Stal', no. 4, 1962, 346 - 348

TEXT: Steel alloys used for springs must display resistance to plastic deformation and resilience. To improve the properties of these alloys tests were carried out to include a thermomechanical treatment in the production process of laminated and helical springs. 55XTP (55KhGR) and 65Г (65G) steels of the following composition were used in the tests: 55KhGR grade steel (in %): 0.53 C; 0.35 Si; 1.0 Mn; 1.1 Cr; 0.003 B; 0.03 Ti; 65G grade steel: 0.64 C; 1.05 Mn; 0.25 Si. The specimens of the first steel grade were heated up to 920°C, rolled on a two-high mill with reductions of 15, 25, 50 and 75% for one pass, then straightened under a press and air-cooled which, for this grade, was equivalent to complete hardening. After this the specimens were tempered at 100, 200, 250 and 300°C for 40 min. The 65G steel grade specimens were treated in 4 different ways: I) Refining and oil hardening at 870°C and tempering at 650°C

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A054/k127

Thermomechanical treatment of

for 1 1/2 h; II) refining + cold deformation (rolling) with a reduction of 12.5% + oil hardening at 870°C + tempering at 650°C for 1 1/2 h; III) refining + rolling (25%) + oil hardening at 870°C + tempering at 650°C for 1 1/2 h; IV) heating to 1,000°C + rolling (25%) quick oil hardening + tempering at 650°C for 1 1/2 h. It was found that the thermomechanical treatment of the 55KhGR steel grade (reduced by 25 - 50%, hardened and tempered at 250 - 300°C) considerably increased the strength and ductility of this spring steel. The thermomechanical treatment has a stabilizing effect on its characteristics, the practical importance being that this stabilizing effect on the steel can be preserved after additional high-temperature tempering, repeated hardening and low-temperature tempering. The repeated heat treatment imparts to the steel specimens, after processing on metal-working machines, the same degree of strength and increased the ductility as obtained during the thermomechanical treatment. In this way it is possible to apply this treatment to many steel grades at the rolling shop, in the last stage of hot rolling. After high-temperature tempering the metal can be subjected to mechanical processing and subsequently to a final heat treatment in the engineering plants. It was found that the heat treatment requires rapid heating. A preliminary cold deformation of the 65G steel grade prior to hardening and tempering results in greater strength than if no workhardening is applied. The mechanical

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Thermomechanical treatment of

characteristics of 65G steel grade, after the four heat treatment schedules given above were the following:

№	$\sigma_B, \text{кг/мм}^2$	$\sigma_s, \text{кг/мм}^2$	$\delta_s, \%$	$\psi, \%$
I	77,6-78,1	45,8-47,9	19,1-17,6	57-54
II	81,6-78,0- 84,1	53,5-54,0- 66,1	14,6-13,7- 13,0	54-53- 49
III	81,7-85,5	65,4-66,4	13,2-13,0	50,4-49,5
IV	85,2-89	72,3-74,7	13,0-12,7	49,7-48,4

The fact that the effect of workhardening is maintained and transferred in the 65G grade steel after hardening and high-temperature tempering was also apparent from x-ray structural analyses of the fine-grained structure of specimens subjected to the four versions of heat treatment. They showed a considerable physical widening of the diffraction lines in specimens which were workhardened. There is 1 table.

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S/136/62/000/006/001/005
E073/E435

AUTHORS: Puchkov, B.I., Rakhshtadt, A.G., Rogel'berg, I.L.
TITLE: Anisotropy of the limit of elasticity of commercial
copper spring alloys

PERIODICAL: Tsvetnyye metally, no.6, 1962, 67-70

TEXT: The results are given of measured values of anisotropy of
the elasticity limit of 0.35 mm thick sheets of bronzes, brasses
and German silver of the following compositions:
Br. A7 (Br. A7): 7.68% Al, 92.20% Cu, 0.05% Fe;
Br. OLI 4-5 (Br. OTs 4-5): 4.14% Sn, 5.02% Zn, 92.74% Cu, 0.02% Fe;
M85 (L85): 14.96% Zn, 84.78% Cu, 0.04% Fe;
M-1165-15-20 (MNTs 65-15-20): 19.80% Zn, 15.10% Ni, 64.71% Cu,
0.08% Fe.

All the alloys were investigated after work hardening (rolling with
a reduction of 57%) and after annealing at a temperature below the
recrystallization temperature. The limit of elasticity was
measured by cyclic loading during longitudinal bending. In the
work hardened state there is a pronounced anisotropy of the limit
of elasticity, the magnitude of which is much higher in the
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S/136/62/000/006/001/005
E073/E435

Anisotropy of the limit ...

direction transverse to rolling (σ'_{el}) than in the direction of rolling (σ''_{el}). The ratio $\sigma'_{el}/\sigma''_{el}$ varied between 1.10 and 1.90. The respective values of the ratio of the moduli of elasticity varied between 1.0 and 1.2; no correlation was detected between the limit of elasticity and the modulus of elasticity. After low (below recrystallization) temperature annealing the limit of elasticity of the investigated materials (with the exception of tin bronze) increased appreciably whereby the increase was greatest in the direction of rolling and least transverse to the direction of rolling. Thus, the anisotropy diminished after low temperature annealing. In the tin bronze, low temperature annealing did not reduce the anisotropy of the limit of elasticity. Thus, low temperature annealing does not only improve the elastic properties of tinless bronzes, brasses and German silver but also reduces the anisotropy of their elastic properties. The authors attribute the anisotropy to the distribution of dislocations and the associated field of oriented microstress. The relatively small change in the anisotropy of the limit of elasticity of tin bronzes as a result of low temperature annealing is probably

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Anisotropy of the limit ...

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E073/E435

caused by the extremely slow diffusion in copper-tin solid
solutions. There are 4 figures and 1 table.

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S/126/62/013/005/013/031
E193/E483

AUTHORS: Puchkov, B.I., Rakhshtadt, A.G., Rogel'berg, I.L.
TITLE: A study of the effect of deformation and annealing
on the anisotropy of the elastic limit of the
7% aluminium copper alloy
PERIODICAL: Fizika metallov i metallovedeniye, v.13, no.5, 1962,
728-734

TEXT: In continuation of an earlier investigation carried out
by B.I.Puchkov and I.L.Rogel'berg (FMM, v.10, 1960, 302) the
present authors conducted a systematic study of anisotropy of
the elastic limit (or, more precisely, of the 0.005% proof stress)
of a copper-base alloy containing 7.1% Al, with particular
reference to the effect of both plastic deformation and
annealing temperature as well as the effect of repeated
deformation and annealing. The experimental material was
prepared by hot rolling 40 mm thick billets to 4 mm sheet which
was then reduced cold to 0.35 mm with intermediate annealing at
700°C. The method described in Ref.4 (A.G.Rakhshtadt and
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A study of the effect ...

S/126/62/013/005/013/031
E193/E483

M.A.Shtremel'. Zavodskaya laboratoriya, v.30, no.6, 1960, 744;
Metallovedeniye i termicheskaya obrabotka metallov, sb.41,
MVTU im. Bauman, 1955, 219) was used to determine $\sigma_{0.005}$
of specimens, cut from the cold-rolled sheet at an angle of
30, 45, 60 or 90° to the direction of rolling. The effect of
the degree of plastic deformation (in rolling) on the anisotropy
of the elastic limit is demonstrated in Fig.1 where $\sigma_{0.005}$
(kg/mm²) is plotted as a function of the orientation of the test
piece in relation to direction of rolling, the vertical and hori-
zontal axes representing respectively, directions parallel and
normal to the direction of rolling; the degree of plastic
deformation is indicated by each curve. The effect of annealing
temperature is demonstrated in Fig.3, where $\sigma_{0.005}$ (kg/mm²) of
specimens given 50% reduction is plotted against the annealing
temperature (°C), curves 1 and 2 relating to values of $\sigma_{0.005}$
in the direction normal and parallel to the direction of rolling,
respectively. The effect of some other factors on the
anisotropy of the elastic limit is shown in Fig.7, where the
vertical and horizontal axes represent again the directions
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A study of the effect ...

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parallel and normal to the direction of rolling and the various curves, showing the variation of $\sigma_{0.005}$, relate to specimens which had been given the following treatment:

- 1 - rolling to 50% reduction; 2 - rolling to 50% reduction followed by rolling in the transverse direction to 8% reduction;
 - 3 - as in 2, plus 30 min at 280°C; 4 - rolling to 92% reduction;
 - 5 - rolling to 92% reduction followed by rolling in the transverse direction to 8% reduction; 6 - as in 5, plus 30 min at 280°C.
- Several conclusions were reached. 1. The plastic deformation-induced structural changes, causing anisotropy of the elastic limit of the alloy studied, can be fully eliminated by annealing the material below the recrystallization temperature.
2. Anisotropy of the alloy annealed below the recrystallization temperature can be fully restored by light plastic deformation.
 3. Anisotropy of plastically deformed material can be substantially altered by rolling the material in the direction normal to the direction of the first rolling operation, even if only a small reduction (7%) is given in the second rolling operation.
 4. Work-hardening of the alloy studied is very non-uniform, and

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A study of the effect ...

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E193/E483

even after very heavy reductions some of the slip system show no resistance to further deformation. The deformation- and annealing-induced changes in the anisotropy of the elastic limit of the 7% Al-Cu alloy are associated with a change in the magnitude and mode of distribution of oriented micro-stresses caused by redistribution of the dislocations. There are 7 figures and 1 table.

ASSOCIATION: "Giprotsvetmetobrabotka" MVTU im. Bauman

SUBMITTED: February 8, 1961 (initially)
December 11, 1961 (after revision)

Card 4/6

S/126/62/014/001/018/018
E193/E383

18.8200

AUTHORS: Rakhshadt, A.G. and Shtremel', M.A.

TITLE: The initial stage of stress relaxation in spring alloys

PERIODICAL: Fizika metallov i metallovedeniye, v. 14, no. 1, 1962, 153 - 157

TEXT: The object of the present investigation was to determine the rate of stress relaxation $\dot{\epsilon}$ and the residual strain ϵ_{OCT} in the initial stages of this process for alloys

listed in Table 1, where their composition is also given. The experiments were carried out on flat test pieces in the following manner: a given bending stress (in the 26 - 55 kg/mm² range for Be bronzes) was applied to the specimen for 5 sec, after which the load was removed and the residual stress measured; this procedure was repeated several times so that ϵ_{OCT} was measured on specimens held under a given stress for a total time ranging from 5 - 1 200 sec. The rate of relaxation was calculated from $\dot{\epsilon} = \Delta \epsilon / \Delta t$, where

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The initial stage of

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$\Delta \epsilon = \epsilon_{i+1}$ is the increase in the residual strain attained in time Δt . It was found that for all the alloys studied the time-dependence of $\dot{\epsilon}$ in the $\log \epsilon / \log t$ coordinates (at $\sigma = \text{const}$) was linear. Similarly, at any given moment of t , $\log \dot{\epsilon}$ increased linearly with increasing σ , although in this case the linear nature of the relationship was less evident and the results were more scattered. A general equation for the stress relaxation (under the conditions employed in the present investigation) was derived on the basis of these results, in the form:

$$\dot{\epsilon} = \frac{C}{t} \cdot k\sigma \quad (1)$$

or

$$\epsilon_{\text{OCT}} = \epsilon_{\text{OCT}}(t_0) + C \cdot k\sigma \ln \frac{t}{t_0} \quad (2)$$

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The initial stage of

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where $t_0 = 5$ sec. The values of constants C and k for alloys studied after various heat treatments are given in another table. The expressions derived by the present authors were used to check the effect of stress relaxation on the accuracy of data on the elastic limit obtained by a method described by them in Zavodskaya laboratoriya, 1960, no. 6, 744. It was found that the error due to this factor was negligible. There are 3 figures and 2 tables. JB

ASSOCIATIONS: Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana. (Moscow Higher Technical School im. Bauman)
Moskovskiy institut stali (Moscow Institute of Steel)

SUBMITTED: October 31, 1961 (initially)
January 23, 1962 (after revision)

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S/126/62/014/006/005/020
E193/E383

AUTHORS: Lozinskiy, M.G., Mirotvorskiy, V.S. and
Rakhshtadt, A.G.

TITLE: A study of ageing of beryllium bronze

PERIODICAL: Fizika metallov i metallovedeniye, v. 14, no. 6,
1962, 834 - 842

TEXT: Microhardness measurements were used to study various aspects of ageing of 2.5% Be-Cu alloys, which were given 24-hours treatment at 780 °C, followed by water quenching, to ensure structural homogeneity of the experimental specimens. Ageing as well as hot-hardness measurements were carried out in vacuum. The investigation covered the following: determination of the temperature-dependence of microhardness of both solution-treated material and specimens aged for 1.5 hours at 350 °C; comparison of microhardness of the alloy at various stages of ageing, both at the ageing temperature and after cooling to room temperature; comparison of the kinetics of ageing in the interior of the grains and in the grain-boundary regions. The results can be summarized as follows. 1) The microhardness of beryllium bronze
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A study of ageing

aged for 1.5 hours at 350 °C increases slightly on heating, reaching a maximum value at about 300 °C and decreasing rapidly above 400 °C. The microhardness of solution-treated specimens also increases on heating due to decomposition of the solid solution but the values obtained at any given temperature are lower than those of the preliminarily aged material. 2) When the beryllium bronze is age-hardened at 350 °C for 30 - 60 min, its maximum microhardness at the ageing temperature is the same as that measured (after ageing) at room temperature. When the ageing time exceeds 60 min the room-temperature microhardness of the alloy becomes lower than that measured at the ageing temperature, the difference between these two values reaching about 90 kg/mm² for alloys aged for 6 hours. 3) The microhardness of solution-treated beryllium bronze is higher in the grain-boundary regions than in the interior of the grains. This effect is due to a higher concentration of beryllium in the grain-boundary regions where - possibly - some precipitation-hardening takes place during quenching. 4) The grain-boundary region and the interior of the grains harden at different rates during ageing. The interior of the grains hardens at a faster rate in the initial

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A study of ageing

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stages of ageing. The microhardness of the grain-boundary zones and the interior of the grains is practically the same at the moment corresponding to maximum hardness; the decrease in hardness in the grain-boundary regions is much more pronounced under conditions of over-ageing. 5) After ageing for 10 min at 350 °C the microhardness of the β -phase in the solution-treated alloy increases from the initial value of 360 kg/mm² to 640 kg/mm². 6) Ageing of beryllium bronze for critical applications should be carried out under conditions which ensure equal hardness at the grain boundaries and in the interior of the grains. The optimum ageing time at 350 °C is 1 hour. There are 7 figures and 2 tables.

ASSOCIATION: Institut mashinovedeniya (Institute of Science of Machines)

SUBMITTED: December 27, 1961 (initially)
June 20, 1962 (after revision)

Card 3/3

BERNSHTEYN, M.L., dotsent, kand.tekhn.nauk; RAKHSHTADT, A.G., dotsent,
kand.tekhn.nauk

Thermomechanical treatment of spring steel and its reversibility.
Stal' 22 no.4:346-348 Ap '62. (MIRA 15:5)
(Steel--Hardening)

11112
S/133/62/000/011/005/005
A054/A127

12.11.62
16.12.62
AUTHORS: Rakhshtadt, A.G., Docent, Meshcherionova, O.N., Candidates of
Technical Sciences, Gnevko, A.I., Soshnikov, S.A., Engineers

TITLE: The effect of boron and titanium on the mechanical properties and
ductility of the new 55 XTP (55KhGR) and 55CT2P (55SG2R) spring
steels

PERIODICAL: Stal', no. 11, 1962, 1041 - 1047

TEXT: At the MBTU im. Bauman (MVTU im. Bauman) and TsNIICM tests were
carried out to improve the quality of 60 C2 (60S2), 55 C2 (55S2) and 55 XTP (55KhGR)
spring steels by the addition of boron (0.003 - 0.01%) and titanium (0.06 - 0.24%).
The new grades were melted in a 50-kg magnesite-lined induction furnace in the
following composition (55KhGR = A', A"; 55S2GR = B', B"; 55S2 = C for control):

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The effect of boron and.....

Heats Canroc								Heats Canroc							
	C	Mn	Si	Cr	Ti	B			C	Mn	Si	Ti	B		
A'	1	0.54	1.02	0.35	1.4	0.06	0.003	S'	1	0.54	1.7	1.25	0.06	0.003	
	2	0.54	1.10	0.32	1.2	0.06	0.006		2	0.55	1.65	1.38	0.06	0.006	
	3	0.55	1.05	0.37	1.3	0.06	0.01		3	0.55	1.7	1.40	0.06	0.01	
A'	1	0.55	1.08	0.24	1.3	—	0.003	B'	1	0.54	1.7	1.08	0.06	—	
	2	0.55	1.1	0.30	1.5	0.06	—		2	0.54	1.5	1.05	0.10	0.003	
	3	0.55	1.04	0.32	1.30	0.09	0.003		3	0.54	1.6	1.1	0.12	0.003	
	4	0.55	0.99	0.32	1.35	0.16	0.003		4	0.54	1.65	1.15	0.24	0.003	
	5	0.55	0.94	0.36	1.30	0.24	0.003								
#C	—	0.53	1.0	1.8	0.3	—	—								

Prior to adding boron the steel was reduced by aluminum, then titanium was added. Tests carried out to study the hardenability of the new grades showed that an addition of 0.003% boron greatly improved this property. Addition of up to 0.06% titanium to steels containing 0.003% boron improves the hardenability still further. When more than 0.06% titanium was added, however, this property of the steel deteriorated, most probably due to the crystallizing effect of titanium compounds leading to the transformation of the supercooled austenite phase. The addition of more than 0.1% titanium weakens the tendency to grain growth in the

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The effect of boron and.....

steel structure, on account of the capping effect of titanium compounds that are not dissolved in the austenite phase, not even at high (up to 1150°C) temperatures. The optimum addition both with regard to grain growth and hardening properties are 0.003% boron and 0.06% titanium. The addition of 0.06 - 0.12% titanium slightly reduces the strength of the test grades. The 55SG2R grade, containing various amounts of boron and titanium has a higher ductility than the conventional 55S2 grade. The threshold of ductility will be attained with 0.003% boron and 0.1 - 0.16% titanium. Optimum ductility for the 55SG2R grade will be obtained with annealing at 350°C, whereas for the 55KhGR grade at 300°C. In the 55SG2R grade the value of stresses reaches the maximum simultaneously with the maximum value of ductility; at the same time the microplastic friction starts developing. Spring steels containing boron and titanium show a lower tendency to decarburization (in 55KhGR grade: 0.01 mm, in 55SG2R: 0.003 mm, whereas in the 55S2 grade: 0.12 mm). The test grades proved superior to the conventional spring steels also in view of relaxation stability, which was tested under uni-axial extension at a stress of $\sigma_0 = 120 \text{ kg/mm}^2$. To obtain a high degree of relaxation stability, the steel must contain sufficient chrome. In general, the optimum amounts of boron and titanium added depend on the steel composition. Greater amounts of

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The effect of boron and.....

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boron and titanium should be added to chrome-manganese steels, than to silico-manganese ones. If higher ductility is required, the boron content should be increased. The 55KhGR grade should be applied for heavy purpose springs. In structures operating under high static stresses, and where the ductility of the spring is not of primary importance, the 55SG2R grade should be used. There are 8 figures.

ASSOCIATION: MBTV im. Bauman (MVTU im. Bauman) and TsNIICM

Card 4/4

PUCHKOV, B.I.; RAKHSHTADT, A.G.; ROGEL'BERG, I.L.; prinimani uchastiye:
ALINARINA, G.A.; SOKOLOVA, I.M.

Anisotropy of the elasticity limit of industrial copper spring alloys.
TSvet. met. 35 no.6:67-70 Je '62. (MIRA 15:6)
(Copper alloys--Testing) (Elasticity)

PUCHKOV, B.I.; RAKHSHTADT, A.G.; ROGEL'BERG, I.L.; SOKOLOVA, I.M.

Effect of plastic deformations and heat treatment on the
anisotropy of beryllium bronze hardening and recovery.
Issl. splav. tsvet. met. no.4:224-232 '63. (MIRA 16:8)

(Beryllium bronze—Hardening)
(Deformations (Mechanics))

L 10691-63

EWP(q)/EWT(m)/BDS--APFTC/ASD--JD

ACCESSION NR: AP3001652

S/0129/63/000/006/0010/0012

AUTHOR: Bron, D. I.; Gruzlov, P. Ya.; Levites, I. I.; Rakhshtadt, A.G. 57

TITLE: The influence of austenization temperature on the kinetics of isothermal transformation of super cooled austenite steel 55 KhGR and 50 KhG 16

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 6, 1963, 10-12

TOPIC TAGS: 55 KhGR steel, 50 KhG steel, austenization temperature, isothermal transformation

ABSTRACT: The stability of austenite 55 KhGR and 50 KhG steel during the isothermal process increases with that of the temperature of heating. In the intermediate region of the transformation, the stability of cooled austenite increases as the temperature rises to 900C, but decreases as the temperature further increases to 1100C. This is explained by the increasing influence of concentration of thermal vacancies on carbon processes in the austenite. The alloying of chrome manganese steel (with a 0.5-0.6% increase of the carbon contents) with boron sharply increase the stability of cooled austenite and hence the hardenability of steel. Orig. art. has: 2 figures.

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S/129/63/000/004/007/014
A004/A127

AUTHORS: Bron, D.I., Rakhshtadt, A.G., Levites, I.I.

TITLE: The effect of thermomechanical treatment on the fatigue strength of 55XTP (55KhGR) grade steel

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, no. 4, 1963, 30 - 31

TEXT: The authors investigated the effect of heat treatment and high-temperature thermomechanical treatment on the fatigue characteristics of the 55KhGR spring steel, containing 0.57% C, 0.36% Si, 1.3% Mn, 1.14% Cr, 0.057% Ti, 0.5% Ni and 0.0037% B. Flat specimens were tested on the NPC -2 (IRS-2) machine in regular symmetric load cycles in one plane. It was found that the optimum tempering temperature for this steel grade was 520 - 560°C. High-temperature thermomechanical treatment improves the fatigue characteristics of this steel, the fatigue limit increase amounting to 10% at least, while the limited durability features a reduction of 50% increase by a factor of 9. The optimum tempering temperatures of 55KhGR steel after high-temperature thermomechanical treatment are in the range of 250 - 300°C. If

Card 1/2

The effect of thermomechanical ...

S/129/63/000/004/007/014
A004/A127

the tempering temperature exceeds 400°C, the effect of high-temperature thermomechanical treatment is taken off. High-temperature thermomechanical treatment with low degrees of reduction (15 - 25%) improve the fatigue characteristics of the steel in the most effective way at a tempering temperature of 250°C. There are 2 figures and 1 table.

ASSOCIATION: MVTU im Bauman

Card 2/2

LOZINSKIY, M.G.; MIROTVOPSKIY, V.S.; RAKHSHTADT, A.G.

Effect of tensile stresses on the beryllium bronze aging process.
Fiz. met. i metalloved. 16 no.3:366-369 S '63. (MIRA 16:11)

1. Institut mashinovedeniya AN SSSR.

PUCHKOV, B.I.; RAKHSHTADT, A.G.; ROGEL'BERG, I.I.

Characteristics of the hardening and recovery of nickel on the results of cold plastic deformation and annealing. Fiz. met. i metalloved. 16 no.5:781-786 N '63. (MIRA 17:2)

1. Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut obrabotki tsvetnykh metallov i Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.

POGODIN--ALEKSEYEV, G.I., doktor tekhn. nauk, prof., otv. red.;
RAKHSHTADT, A.G., kand. tekhn. nauk, dots., nauchn. red.;
SHREYBER, G.K., kand. tekhn. nauk, dots., nauchn. red.;
BERNSHTEYN, M.L., doktor tekhn. nauk, red.; LAKHTIN, Yu.M.,
doktor tekhn. nauk, prof., red.; RUSTEM, S.L., kand. tekhn.
nauk, dots., red.; FEDOTENKO, N.S., inzh., red.

[Study of metals and their heat treatment] Metallovedenie i
termicheskaya obrabotka. Moskva, Mashinostroenie, 1964.
195 p. (MIRA 18:7)

1. Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy
promyshlennosti. Sektsiya metallovedeniya i termicheskoy
obrabotki.

L 45060-65 EWT'(z)/EWP'(z)/EWP(b)/T/EWA'(d)/EWP(t)/EWP(w) MJW/JD

ACCESSION NR: AR5008955

S/0277/65/000/001/0013/0014

21
19
B

SOURCE: Ref. zh. Mashinostroitel'nyye materialy, konstruktsii i raschet detaley mashin. Otd. vyp., Abs. 1.48.55

AUTHOR: Rakhshtadt, A. G.; Sol'ts, V. A.; Nosan', L. T.

TITLE: Analysis of the properties of steels EP51 and EP52 at high temperatures

CITED SOURCE: Sb. Metallovedeniye i term. obrabotka. M., Mashinostroyeniye, 1964, 67-77

TOPIC TAGS: spring steel, high temperature test, steel mechanical property, EP51 steel, EP52 steel, EI702 steel

TRANSLATION: New spring steels EP51 and EP52, containing, similarly to EI702 steel, (in%) ≤ 0.05 C, ≤ 0.5 Si, 0.8 - 1.2 Mn, 11.5 - 13.5 Cr, 34.5 - 36.5 Ni, 2.8 - 3.2 Ti and 0.9 - 1.2 Al, but including in addition 4.5 - 6.0 and 7.8 - 8.5% Mo, respectively, were tested for mechanical properties in a heated state. Steels containing Mo exhibit a narrower temperature range of high plasticity (950-1150C for EP51, 1000-1150C for EP52, 950-1200C for EI702) and higher levels of σ_b , especially up to 950C. Properties at temperatures up to 500C, after

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L 45060-65

ACCESSION NR: AR5008955

2

quenching from 960 or 1100C and tempering at 750C, were studied to determine the applicability of EP51 and EP52 as spring steels. The Mo³ alloyed steels exhibited substantially higher σ_b and σ_s than EI702 steel. EP52 steel does not soften up to 500C. Quenching from 960C resulted in higher σ_b for all steels than quenching from 1100C. All three steels exhibited a similar temperature dependence of Young's modulus. The dependence of the plastic limit on temperature and results obtained in relaxation tests indicate that steels with Mo surpass EI702 steel in heat resistance. The plastic limit of EI702 steel begins to drop above 200C, for EP51 above 300C. EI702 steel has peak relaxational stability when quenched from 950-1000C and tempered at 700C. Comparable data for EP51 were 1050-1100C and 750C (2 hrs.) or 700C (8 hrs.); for EP52 the respective values were 1150C and 750C (2 hrs.). The maximum operating temperature was 200C for spring made of EI702, 300C for EP51 and 400C for EP52. Bibl. with 6 titles; 1 table, 9 illustrations. Yu. A.

SUB CODE: MM

ENCL: 00

Card 2/2 mB

BRON, D.I.; BERNSHTEYN, M.L., doktor tekhn.nauk; RAKHSHTADT, A.G., kand.
tekhn.nauk; LEVITES, I.I.

Hardening 55KhGR spring steel by the method of high-temperature
thermomechanical treatment. Avt.prom. 30 no.1:35-38 Ja '64.
(MIRA 17:3)

1. Nauchno-issledovatel'skiy tekhnologicheskiy institut
avtomobil'noy promyshlennosti, Moskovskiy institut stali i splavov
i Moskovskoye vyssheye tekhnicheskoye uchilishche imeni Baumana.

RYZHOV, N.M.; KOTOV, A.N.; RAKESHTADT, A.G.

Resonance apparatus for fatigue testing of sheet materials at
various temperatures. Zav. lab. 30 no.6:751-752 '64
(MIRA 17:8)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche imeni
Baumana.

I. 45378-65 EWT(m)/ENP(w)/EWA(d)/T/ENP(t)/ENP(k)/ENP(z)/ENP(b)/EWA(c) Pf-L/Pad IJP(c)

ACCESSION NR: AF5007001

S/0129/65/000/003/0017/0022

AUTHOR: Puckhov, B. I.; Rakhshtadt, A. G.; Rogel'berg, I. L.; Gavze, A. L.

TITLE: Hardening of copper and nickel alloys during prerecrystallization annealing, and softening with repeated deformation

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 3, 1965, 17-22, and insert facing p. 25

TOPIC TAGS: metal hardening, metal softening, anisotropy, metal physical property, plastic deformation

ABSTRACT: The article discusses the effect of repeated deformation (carried out after prerecrystallization annealing) on the hardness of metals and alloys and their resistance to small plastic deformations. Nonremelted electrolytic nickel, a single-phase alloy (aluminum bronze with 7% Al), and a two-phase precipitation hardening alloy (beryllium bronze) containing 2.53% Be and 0.31% Ni were studied. Strips of the alloys were rolled, subjected to prerecrystallization annealing, and repeated deformation (rolling) with different degrees of work hardening. Hardening and softening were evaluated from changes in hardness and tensile strength, and

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ACCESSION NR: AP5007001

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softening was measured on specimens cut at different angles to the direction of rolling. Repeated deformation was found to cause considerable softening in all cases. Softening was most apparent in the fall-off of resistance to small plastic deformations. Repeated plastic deformation in the direction of the initial deformation raises the elastic limit, but does not change the anisotropy of the elastic limit. A change in the direction of the repeated deformation changes this anisotropy by increasing the hardening in some directions and softening the alloy in others. Repeated plastic deformation of alloys following the initial deformation and prerecrystallization annealing causes softening in all directions, but to different degrees. The type of anisotropy depends on the direction of the second deformation with respect to the first. The Konobeyevskiy-Rovenskiy effect is based on the fact that polygonization appears during prerecrystallization annealing and breaking up of the polygonized substructure during repeated deformation. This effect is general and inherent for both pure metals and alloys; changes in the fine structure of alloys are complicated by redistribution of component atoms, and therefore these changes have a more pronounced effect on softening and hardening in alloys. Orig. art. has: 4 figures.

Card 2/3

L 45378-65

ACCESSION NR: AP5007001

ASSOCIATION: MVTU im. Bauman, GIPROTSVETMETOBRABOTKA

SUBMITTED: 00

ENCL: 00

SUB CODE: MM

NO REF SOV: 007

OTHER: 000

Card 3/3

L 45377-65 EWT(m)/EWP(w)/EWA(d)/EPR/T/EWP(t)/EWP(z)/EWP(b) Ps-4 IJP(c) MJW/JD

ACCESSION NR: AP5007002

S/0129/65/000/003/0022/0028

AUTHOR: Pastukhova, Zh. P.; Ivanova, T. V.; Puchkov, B. I.; Rakhshtadt, A. G.; Rogel'berg, I. L.

TITLE: Effect of microalloying on the properties of aluminum bronze

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 3, 1965, 22-28

TOPIC TAGS: aluminum alloy, aluminum bronze, hardening, mocoanalysis

ABSTRACT: The influence of microalloying on the properties of bronze Br.A7 after deformation and prerecrystallization annealing were studied. ¹⁶Phosphorus, boron, and beryllium were used as the alloying elements. The alloys contained 7% Al and 0.03, 0.07, 0.13% P; or 0.0053, 0.0095, 0.0188% B; or 0.0055, 0.009, 0.06% Be. From a deformed strip, specimens were prepared on which the elastic limit, relaxation resistance, and hardness were measured. The greatest effect of phosphorus on the properties of bronze is manifested after prerecrystallization annealing; the hardening produced is apparently due to the formation of segregations and even regions of excess phase. Introduction of boron increases the elastic limit only slightly, and the greatest hardening is also observed after prerecrystallization

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ACCESSION NR: AP5007002

annealing. As in the case of phosphorus, the optimum annealing temperature is independent of the boron concentration. In the case of beryllium, ⁴ in contrast to boron and phosphorus, a maximum hardening at low Be concentrations (about 0.005%) is followed by a decline, and then by another increase. The first maximum is due to the formation of segregations, and the second, to the separation of an excess phase whose particles prevent dislocation movement. For the same atomic concentration of the three elements tested, the hardening produced by phosphorus is the most pronounced. Relaxation tests confirmed the high thermal stability of the alloyed bronzes. Orig. art. has: 8 figures.

ASSOCIATION: MVTU im. Bauman, GIPROTSVETMETOBRABOTKA

SUBMITTED: 00

ENCL: 00

SUB CODE: MM

NO REF SOV: 005

OTHER: 001

Card ^{SV} 2/2

L 60030-65 EWT(m)/ENA(d)/EWP(k)/EWP(t)/EWP(z)/EWP(b)/ENA(c) Pf-4/Pad
TJP(c) MJH/JD/HW

ACCESSION NR: AP5018053

UR/0129/65/000/007/0025/0029
621.785:539.374

AUTHOR: Rakhshtadt, A. G.

TITLE: New method of strengthening age-hardenable alloys 6

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 7, 1965, 25-29

TOPIC TAGS: age hardenable alloy, thermomechanical treatment, double thermomechanical treatment, alloy strength, alloy ductility/36NKhTYu alloy, 42 NKhTYu alloy, 36NKhTYuM8 alloy 18 14

ABSTRACT: A new method of strengthening age-hardenable alloys has been developed at the MVTU im. Baumana. The new method, designated "double thermomechanical treatment (TMO)," differs from single TMO (austenitizing, quenching, and cold working) in that the metal, after cold working with a given degree of reduction, is rapidly reheated to the austenitizing temperature, held for several seconds, and then quenched. The temperature and holding time of the second austenitizing depend on the reduction in cold working. After such treatment the alloy retains the structure of a super-saturated solid solution, has a uniform distribution of structural imperfections, and is free of local stresses. Subsequent aging brings about additional uniform strengthening. Double TMO of 36NKhTYu, 42NKhTYu, and 36NKhTYuM8 iron-chromium-nickel

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L 60030-65

ACCESSION NR: AP5018053

base, age-hardenable alloys significantly increased their resistance to small deformations, eliminated anisotropy of mechanical properties, slightly increased hardness, and appreciably increased ductility. The yield strength after double TMO and aging ($\sigma_{0.002} = 112$ and 124 kg/mm^2 for 36NKhTYu and 36NKhTYuM8 alloys, respectively) was slightly lower than after single TMO and aging (115 and 130 kg/mm^2), but the elongation was significantly higher (8% and 2—3%, respectively). After double TMO the alloys also had higher rupture, fatigue, and relaxation strengths and thermal shock resistance. The EI652 heat-resistant, nickel-base alloy after double TMO had a yield strength of 42.5 kg/mm^2 at 800°C , compared to 27.5 kg/mm^2 after conventional annealing. Double TMO of EI435 [U.S. Nimonic 75] alloy did not improve its tensile properties at 800°C , but it nearly doubled its ductility, e.g., the elongation increased from 15.5 to 30.7%. The new strengthening method can also be applied to alloys which are not strengthened by conventional quenching and aging or by single TMO (N35KhM8, 40KhNM, etc.). Orig. art. has: 3 figures and 1 table. [MS]

ASSOCIATION: MVTU in Bauman

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, IE

NO REF SOV: 000

OTHER: 000

ATD PRESS: 4058

Card 2/2 3/11

SPEKTR, E.N.; GORELIK, S.S.; RAKHSHTADT, A.G.

Structural changes in Fe and the alloy of Fe with 3,5% silicon
during subcritical annealing. Izv. vys. ucheb. zav.; Chern. met.
8 no.7:141-144 '65. (MIRA 18:7)

1. Moskovskiy institut stali i splavov.

L 11545-66

EWT(m)/EWP(w)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b)/EWA(c) MJW/JD

ACC NR: AP5028961

SOURCE CODE: UR/0119/65/000/009/0017/0020

AUTHOR: ^{44,55} Mishkevich, R. I. (Candidate of technical sciences); ^{44,55} Puchkov, B. I. (Engineer); ^{44,55} Rakhshtadt, A. G. (Doctor of technical sciences); ^{44,55} Rogel'berg, I. L. (Candidate of technical sciences)

ORG: none

TITLE: Relaxation resistance of spring alloys ^{44,55}

SOURCE: Priborostroyeniye, no. 9, 1965, 17-20

TOPIC TAGS: stress relaxation, brass, bronze, copper base alloy, annealing, metal test

ABSTRACT: The results of an experimental investigation of the relaxation resistance of copper-base alloys under stress and after low-temperature annealing are reported; the alloys were tested at room temperature and heated up to 100-200°C. Ribbons 0.25-0.30-mm thick of these brasses and bronzes were tested: L62, L85, L80, L68, Br. OF6,5-0,15, Br. OF4-0,25, Br. OTs. 4-3, Br. A7, Br. KMTs 3-1, MNTs 15-20. Test curves and tabulated data permit drawing these conclusions:
(1) Stress relaxation of principal copper-base alloys used in instruments was

Cord 1/2

UDC: 620.17:62.272:669.35

L 11545-66

ACC NR: AP5028961

determined at 20C for 50000 hrs and at 100-200C for 300 hrs; (2) Low-temperature annealing of all alloys except Br. OF4-0,25 bronze materially enhances the relaxation resistance at 20C; the highest relaxation resistance was found in Br. KMTs 3-1, Br. OTs. 4-3, and nickel silver; (3) The low-temperature annealing also enhances the relaxation resistance of hot alloys; (4) The MNTs 15-20 alloy exhibited a highest relaxation resistance with and without the low-temperature annealing; other alloys are unfit for using in springs that work at higher temperatures. Orig. art. has: 8 figures and 2 tables.

SUB CODE: 11 / SUBM DATE: none / ORIG REF: 001

HW
Card 2/2

L 1052-66 EWT(m)/EWP(w)/EWA(d)/T/ENP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c) MJW/JD/HW

ACCESSION NR: AP5022355

UR/0133/65/000/009/0846/0848 51
669.18:658.562 50

AUTHOR: Supov, A. V.; Prokoshkin, D. A.; Rakhshtadt, A. G.; Medvedev, V. A. ^{44.55} ^{44.55} ^{44.55} ^{44.55}

TITLE: Effect of cold working on the physical properties and fine structure of steel subjected to thermomechanical treatment ¹⁴

SOURCE: Stal', no. 9, 1965, 846-848

TOPIC TAGS: cold working, spring steel, metal hardening, plastic deformation, mechanical heat treatment/ 55KhRG, spring steel ^{18,44.55}

ABSTRACT: The hardening that occurs in steels following their thermomechanical treatment (TMT) is usually associated with the rise of a special fine structure with a higher density of defects and a corresponding distribution of defects. Hence it may be expected that on additional treatment of the fine structure (e.g. by means of limited plastic deformation) the properties of steel previously subjected to TMT should also markedly change. In this connection, the authors investigated the effect of cold plastic deformation on the properties of spring steel 55KhRG (0.52% C, 0.9% Cr, 1.1% Mn, 0.005% B) following its high-temperature

Card 1/3

L 1052-66

ACCESSION NR: AP5022355

thermomechanical treatment (HTMT), on utilizing the hereditary hardening effect (the "reversibility" effect) which consists in that if a steel, following its HTMT, is tempered to a hardness allowing its machining with cutting tools, its reheating without deformation and tempering causes it to re-acquire the properties it had acquired directly following HTMT, i.e. the effect of the original work hardening is stably retained. In this particular case, "direct" HTMT was carried out at 950°C with deformation by rolling leading to a 50% reduction of area. Immediately after deformation the steel was quenched in oil. Subsequently, the specimens were tempered at 200-600°C; prior to tempering some of the specimens were cold-rolled with a 5% reduction in area. Reheating of the specimens produced the "hereditary hardening effect," i.e. restoration of the high level of strength properties, except in the specimens subjected to the cold plastic deformation with 5% reduction in area, which shows that even a limited degree of cold working eliminates the "hereditary hardening effect" by disturbing the uniformly distributed and stabilized systems of dislocations. The character of change in properties corresponds to the change in fine structure. The physical widening of the diffraction lines of the atomic planes of α -solid solution is greater without than with such cold working, in such cases. Orig. art. has: 3 figures.

2/3

Card

L 1052-66

ACCESSION NR: AP5022355

ASSOCIATION: none

SUBMITTED: 00

ENCL: 00

SUB CODE: MM, SS

NO REF SOV: 005

OTHER: 000

Card 3/3

DP

L 57818-65 EEC(b)-2/EPF(n)-2/EWP(k)/EWA(c)/EWT(1)/EWT(m)/EWP(b)/T/EWA(d)/
EWP(t) Pf-4/Pi-4/Pu-4 IJP(c) GG/JD/HW/JG

ACCESSION NR: AP5008789

S/0126/65/019/003/0424/0431

539,292; 548.0 : 539

52

49

B

AUTHOR: Spektor, E. N.; Gorelik, S. S.; Rakhshtadt, A. G.; Novikova, M. B.

TITLE: Effect of pre-recrystallization annealing on the properties and structure of deformed metals with a body-centered cubic lattice

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 3, 1965, 424-431

TOPIC TAGS: crystal lattice structure, anisotropy, elastic anisotropy, nonferrous metal alloy

ABSTRACT: Variations in elastic properties are studied in connection with structural changes during pre-recrystallization of metals with a body-centered cubic lattice. The materials in the investigation were commercially-pure niobium, an alloy of niobium with 1 at % titanium and an alloy of molybdenum with a small amount of zirconium(0.2%). In niobium and molybdenum a sharp increase was observed in the elastic limit (resistance to small plastic deformations) which reached 50-100% and was similar to that noted earlier in metals and alloys with a face-centered cubic lattice. In the deformed state niobium and molybdenum are characterized

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L 57818-65

ACCESSION NR: AP5008789

by an insignificant anisotropy in the elastic limit and modulus of normal elasticity. At annealing temperatures near the beginning of recrystallization the anisotropy in the elastic limit of molybdenum disappears, but remains for niobium and an alloy of niobium with titanium. The anisotropy in the modulus of niobium and molybdenum shows a partial reduction. An increase in the deformation temperature of molybdenum to 600°C results in nearly complete disappearance of the anisotropy in the elastic limit both directly after deformation and after annealing. No similar connection exists between the change in the elastic limit and its anisotropy and the change of the crystallographic orientation. Pre-recrystallization annealing does not change the basic type of orientation but is accompanied by a change in the intensity and the dispersion of orientation maxima. Addition of 1 at % titanium has a sharp effect on the orientation of deformed niobium and its change during heating, increases the elastic limit in the deformed state and the degree of anisotropy, and increases the temperature of initial recrystallization. Increasing the rolling temperature of molybdenum to 600°C decreases the scattering of orientation maxima both directly after deformation and after annealing, and also changes somewhat the alignment of the basic orientation maxima. It is concluded that the basic reason for the increase in the resistance of molybdenum and niobium to small plastic deformations is the redistribution of dislocations and disappearance of the most ac-

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L 57818-65
ACCESSION NR: AP5008789

2
tive portion of the dislocations with the formation of a more stable dislocation configuration. The change in resistance to small plastic deformations is considered to be an extremely sensitive characteristic of the structural changes which occur as the result of recovery during pre-recrystallization annealing. Orig. art. has: 6 figures, 2 tables.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

SUBMITTED: 17Feb64

ENCL: 00

SUB CODE: MM, SS

NO REF SOV: 003

OTHER: 002

Card
3/3

SUPON, A.V.; PROKOPEIN, D.A.; KURBATOV, A.G.; KROVCHENKO, V.A.

Effect of cold hardening on mechanical properties and fine structure of heat treated steel. Stal' 25 no.8:846-848 S
'65. (MIRA 18:9)

1. Gosudarstvennyy nauchno-issledovatel'skiy institut po promyshlennoy i sanitarnoy ochistke gazov.

RAKHSHTADT, Aleksandr Grigor'yevich; NAUMOVA, Ye.A., red.

[Modern methods of hardening alloys used in the manufacture of springs] Sovremennye metody uprochneniia pruzhinnykh splavov. Leningrad, 1965. 38 p. (MIRA 19:1)

L 31820-66 EWP(e)/EWT(m)/EWP(w)/T/EWP(t)/ETI IJP(c) JD/HW/JG
 ACC NR: AP6019500 (N) SOURCE CODE: UR/0129/66/000/006/0012/0016
 AUTHOR: Borisov, V. A.; Rakhshtadt, A. G.; Shpitsberg, A. L. 58
 ORG: MVTU im. Bauman 51
 TITLE: Properties of additionally alloyed nickel-beryllium alloys B
 SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 6, 1966, 12-16
 TOPIC TAGS: nickel alloy, beryllium containing alloy, molybdenum containing alloy, boron containing alloy, tungsten containing alloy, vanadium containing alloy, cobalt containing alloy, spring alloy, alloy heat treatment, alloy property
 ABSTRACT: EI996 nickel-base alloy with 2% beryllium (1) is used to manufacture current-carrying contact springs and elastic elements working at temperatures of 250C or over. In a search for materials with better structural stability, electric conductivity, and plasticity, a series of nickel-beryllium alloys additionally alloyed with 5.6% Mo (2), 5.6% Mo + 0.0025% B (3), 1.8% W (4), 1.7% W + 0.2% V (5), 0.95% Co (6), 2.6% Co (7), 4.8% Co (8), or 4% Co (9) were tested in the form of wires 1.5 mm in diameter. Water quenching from 1100C and tempering at 550C was found to be the optimum heat treatment for all the alloys tested. Alloys (3) and (5) showed the best combination of mechanical properties: a hardness HB of 540 and 520, elastic limit 52 and 47.5 kg/mm², electric resistivity 0.397 and 0.251 ohm·mm²/m, respectively, compared to HB 480, elastic limit 27 kg/mm², and electric resistivity 0.298 ohm·mm²/m
 Card 1/2 UDC: 669.15-194:669.25'72

ACC NR: AM6004543

Monograph

UR/

Rakhshtadt, Aleksandr Grigor'yevich

Spring alloys; properties and heat treatment (Pruzhinnyye splavy; svoystva i termicheskaya obrabotka) Moscow, Izd-vo "Metallurgiya", 65. 0362 p. illus., biblio. 3,250 copies printed.

TOPIC TAGS: alloy, mechanical heat treatment, metal hardening, strain hardening, work hardening, spring steel, stainless steel, austenitic steel, corrosion-resistant steel, martensitic transformation, corrosion-resistant alloy, non-ferrous metal alloy, Young modulus, copper-base alloy

PURPOSE AND COVERAGE: The book examines theoretical and experimental data on the properties and principles of obtaining high-grade spring alloys; the principles of alloying, heat and mechanical heat treatment. It gives the compositions of spring alloys, conditions for heat and mechanical heat treatment, which guarantee the attainment of optimum alloy properties. It also deals with the composition, properties and methods of hardening non-ferrous spring alloys - (bronze and brass). The book is intended for engineers-technical workers of metallurgical, machinery manufacturing, and instrument building enterprises and scientific-research institutes. It can also be used for students of technical higher educational institutions.

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UDC: 669.018.2

ACC NR: AM5004543

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SPECIAL PURPOSE SPRING ALLOYS (WITH PARTICULAR PHYSICO-CHEMICAL PROPERTIES)

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SUB CODE: 11,13 /SUEM DATE: 25Aug65/ ORIG REF: 317/ OTH REF: 153/

Card 2/2

RAKHSHTADT, S. G.

18(0)

PHASE I BOOK EXPLOITATION

SOV/2720

Spravochnik po mashinostroitel'nykh materialam. tom 1: Stal'
(Handbook on Machine-building Materials. vol 1: Steel)
Moscow, Mashgiz, 1959. 907 p. Errata slip inserted.
32,000 copies printed.

Scientific Eds.: V.G. Vorob'yev, Yu. M. Lakhtin, S.G. Rakhshadt,
and S.L. Rustem; Ed. of this Vol.: Yu.A. Geller, Doctor of
Technical Sciences; Ed.: G.I. Pogodin-Alekseyev; Ed. of
Publishing House: G.A. Molyukov, Engineer; Tech. Ed.:
T.F. Sokolova; Managing Ed. for Reference Literature (Mashgiz):
I.M. Monastyrskiy, Engineer.

PURPOSE: This handbook is intended for engineering and technical
personnel in production departments, laboratories, and construc-
tion and design offices. It may also be useful to teachers and
students of tekhnikums and vtuzes.

COVERAGE: The material presented in this first volume is based on
State Standards, technical specifications, and generally accepted

Card 1/27

Handbook on Machine-building Materials (Cont.)

SOV/2720

findings of scientific research institutes. The handbook consists of 4 volumes, the first dealing with steel, the second with nonferrous metals and alloys, the third with cast iron, and the fourth with nonmetallic materials. No personalities are mentioned. References follow each chapter.

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Ch. I. General Information on the Structure, Properties, and Heat Treatment of Steel (N.F. Bolkhovitinov, Doctor of Technical Sciences)	
Structure of iron-carbon alloys	11
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RAKHATANOV, I.

A team from Vtorovo. Voen.znan. 25 no.9:18 S '49.
(MIRA 12:12)

(Vtorovo--Airplanes--Models)

RAKHTANOV, P.P. (Barnaul)

"Pages from life " by S.R. Mirotvortsev. Reviewed by P.P. Rakhtanov.
Nov.khir. arkh. no.1:82-84 Ja-F '58 (MIRA 11:11)
(MIROTVORTSEV, SERGEI ROMANOVICH, 1878-1949)

BERIN, M.G.; ZAGIDULLIN, A.Kh.; PETROVA, V.I.; KANETANOVA, Ye.P.

Detection of Mycobacterium tuberculosis by fluorescence and phase contrast microscopy. Nauch. trudy Kaz. gos. med. inst. 14:101-102 '64. (MIRA 18:9)

1. Kafedra mikrobiologii (zav. - dotsent Z.Kh.Karimova) i kurs tuberkuloza (zav. - prof. B.I.Mazur) Kazanskogo meditsinskogo instituta.

RAKHTEENKO, A. M.

USSR/Radio - Receivers, Portable
Tubes, Miniature

May 51

"A Portable Radio," A. M. Rakhtenko

"Radio" No 5, pp 35-37

Describes portable radio for long- and medium-wave bands using two 1K1P tubes. In the Moscow region, receives 3 Moscow programs on headphones without outside antenna or ground. Filament circuit draws 120 ma at 1.2 v, plates and screen grids, 5 ma at 45 v. Dimensions are 100 x 100 x 135 mm, weight is 185 g.

1821108

RAKHTEYENKO, A., inzh.; DEMIN, V., inzh.; LOMANOVICH, V., inzh.

Bookshelf. Radio no.9:63-64 S '63.

(MIRA 16:12)

RAKHTEYENKO, A. M.

PHASE I

TREASURE ISLAND BIBLIOGRAPHICAL REPORT

AID 154 - I

BOOK

Call No.: TK6563.R35

Author: RAKHTEYENKO, A. M.

Full Title: POCKET RADIO RECEIVERS

Transliterated Title: Karmannyye radiopriyemniki

Publishing Data

Originating Agency: Popular Radio Library

Publishing House: State Publishing House of Literature on Power Engineering.
(GOSENERGOIZDAT)

Date: 1952

No. pp.: 16

No. of copies: 25,000

Editorial Staff

Editor: Gansburg, M. D.

Tech. Ed.: None

Editor-in-Chief: Berg, A. I., Academician

Appraiser: None

Text Data

Coverage: Popularized descriptions with diagrams and pictures of three types of pocket radio receivers are given for bands from 200 to 2,000 meters of wave length. The receivers are especially suitable for geological and other expeditions and for scout camps.

The book does not possess practical value.

Purpose: Information for radio amateurs

Facilities: None

No. of Russian and Slavic References: None

Available: Library of Congress.

RAKHTEYENKO, I.N., kandidat tekhnicheskikh nauk.

Interrelation of root system of some trees. Izv.AN BSSR, No.5:
67-80 S-O '53. (MLRA 9:1)
(Roots (Botany)) (Forest ecology)

RAKHTSEYENKA, I.N.

Mineral nutrition of trees with interaction of their root systems.
Vosto: AN BSSR, Ser. bial. nav. no.4:103-110 '56. (MLRA 10:6)
(Plants--Nutrition)